PATENT APPLICATION

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MOBILE HANDSET AS TTY DEVICE

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BACKGROUND OF THE INVENTION

Field of the Invention (Technical Field):

The present invention relates generally to the field of communication processes and devices for hearing and/or speech impaired individuals, and in particular to the field of TTY communications over wireless mobile communication devices.

Background Art:

Hearing impaired and/or speech impaired individuals rely on a variety of communications devices to communicate. Statutes, such as the Americans with Disabilities Act and the Telecommunications Act, provide that telecommunications service providers and telecommunication device manufacturers enhance communication devices such that hearing and/or speech impaired individuals can communicate effectively over existing telecommunication networks.

Many hearing and/or speech impaired individuals communicate with other individuals over existing landline telephone networks primarily via a Telecommunication Device for the Deaf (TDD), which consists of an alphanumeric keyboard and display, or teletypewriter (TTY), that is connected to the telephone through a modem. When a user enters alphanumeric characters on the TTY, tones corresponding to the characters are transmitted via the modem through the telephone line to a receiving TDD. At the receiving TDD, the tones are received by a second modem and converted back to characters to be read by the receiving party on a TTY. A conversation proceeds by taking turns in real time, where the users type messages back and forth over TDDs.

Each character is transmitted and received via a TTY format, most commonly the Baudot/Weitbrecht (hereafter "Baudot") tone format. In the Baudot format, transmitted tones include a mark tone of 1,400 Hz and a space tone of 1,800 Hz. Serial sequences of marks and spaces provide five-bit binary numbers representing a limited set of characters, including letters of the alphabet, numerical digits, punctuation marks, and space characters. A typical TTY can support 32 characters as shown in Table 1 below. These five-bit words are transmitted over telephone lines at approximately 45.45 or 50 baud.

Code Signals • Denotes possible current							LTRS Shift	FIGS Shift	
								CCITT Standard International Telegraph Alphabet No. 2 Used for Telex	North American Teletype Commercial Keyboard
Start	1	2	3	4	5	Stop			
	•	•				•	A	---	---
	•			•	•	•	B	?	?
		•	•	•		•	C	:	:
	•			•		•	D	Who are you?	$
	•					•	E	3	3
	•		•	•		•	F	Note 1	!
		•		•	•	•	G	Note 1	&
			•		•	•	H	Note 1	#
		•	•			•	I	8	8
	•	•		•		•	J	Bell	Bell
	•	•	•	•		•	K	(	(
		•			•	•	L	)	)
			•	•	•	•	M	.	.
			•	•		•	N	,	,
				•	•	•	O	9	9
	•	•	•		•	•	P	0	0
		•	•			•	Q	1	1
		•		•		•	R	4	4
	•		•			•	S	'	'
					•	•	T	5	5
	•	•	•			•	U	7	7
		•	•	•	•	•	V	=	:
	•	•			•	•	W	2	2
	•		•	•	•	•	X	/	/
	•		•		•	•	Y	6	6
	•				•	•	Z	+	"
						•	Blank		
	•	•	•	•	•	•	Letters shift (LTRS)		
	•	•		•	•	•	Figures shift (FIGS)		
			•			•	Space		
				•		•	Carriage return		
		•				•	Line feed		

Table 1

With the advent of mobile communication devices, such as mobile cellular and satellite telephones, pagers, personal digital assistants (PDAs), and the like (hereafter "mobiles"), the Federal Communications Commission (FCC) requires that every mobile manufactured be capable of communicating TTY 911 emergency calls. In order to facilitate the development of TTY communication over digital wireless communication systems in particular, wireless carriers formed the "TTY Forum" in 1997, participants of which included consumers, representatives from government emergency centers, wireless product manufacturers and service providers, and TTY equipment manufacturers. In response to this directive, mobile manufacturers have provided mobiles with the ability to communicate with TTY devices.

Currently, to communicate TTY data via a mobile, an external TTY device must be connected to the mobile through the mobile audio jack. Once the TTY is connected to the mobile, the mobile is set by the user to operate in TTY mode, so that the mobile will transmit and receive data in the TTY data format. The TTY generates tones based upon alphanumeric characters input by the user. The mobile detects these tones through the audio jack. The tones are then transmitted to the receiving mobile over conventional mobile communication means, typically via wireless radio frequency (rf) transmission. To transmit the Baudot tones, the data is encoded with the appropriate TTY packet data extension so that the telecommunications base station and receiving mobile will interpret the incoming signal as a TTY signal. When a mobile receives a TTY signal, a decoder decodes the signal and sends the data to a tone regenerator. These tones are sent back to a TTY device for decoding and display to the receiving user.

One difficulty with TTY communication over mobiles, expressed by consumer advocates, is that in certain mobiles, direct connection through the audio jack blocks access to the microphone in the mobile preventing the user from efficiently alternating between receiving TTY and speaking during a call. Without some means of switching modes in this circumstance, a voice carry over (VCO) user must disconnect the audio cable every time it is the user's turn to speak. Voice carry over is a form of telecommunications relay service where a person with a hearing disability is able to speak directly to the other user, rather than sending data via a TTY. A communications assistant types the response from the other user back to the person with the hearing disability who reads the response from a TTY.

Another difficulty with connecting a TTY device through the mobile audio jack is that some mobiles do not permit simultaneous connection of the audio jack and the mobile power adapter. The audio jack may be located too close to the access point for the power cord, preventing the TTY user from making a call while the mobile is connected to a power outlet.

SUMMARY OF THE INVENTION (DISCLOSURE OF THE INVENTION)

A primary object of the present invention is to provide a mobile capable of receiving alphanumeric data input by the mobile user on the mobile and converting that data into TTY formatted data for transmission over a mobile communication system, eliminating the requirement of an external TTY device connected to the mobile. Another primary object of the present invention is to provide a mobile capable of receiving TTY formatted data and converting it into alphanumeric data for display on the mobile display to the user.

The present invention is a mobile communication device having TTY communication capability. A microprocessor operating in the mobile communication device converts between alphanumeric data and TTY formatted data appropriate for transmission or reception by the mobile communication device.

A primary advantage of the present invention is that hearing and/or speech impaired individuals can communicate over mobiles without connecting an external TTY device to the mobile. Users can enter alphanumeric data on the mobile keypad for transmission, and can read received TTY formatted data as alphanumeric characters on the mobile display.

Other objects, advantages and novel features, and further scope of applicability of the present invention will be set forth in part in the detailed description to follow, taken in conjunction with the accompanying drawings, and in part will become apparent to those skilled in the art upon examination of the following, or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated into and form a part of the specification, illustrate a preferred embodiment of the present invention and, together with the description, serve to explain the principles of the invention. The drawings are not to be construed as limiting the invention.

Fig. 1 is a block diagram of a preferred digital embodiment of the method and apparatus of the present invention for a mobile handset as a TTY device; and

Fig. 2 is a block diagram of a preferred analog embodiment of the method and apparatus of the present invention for a mobile handset as a TTY device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS
(BEST MODES FOR CARRYING OUT THE INVENTION)

With reference to Figs. 1 and 2, the present invention for a mobile handset **10** as a TTY device is shown. The mobile **10** of the present invention contains a conversion table stored in a memory associated with a microprocessor of mobile **10**, this memory being part of the microprocessor or a memory external to the microprocessor. The conversion table contains the information necessary for converting between alphanumeric data and TTY formatted data. Mobile **10** also incorporates a suitable routine operating in the microprocessor to perform conversion from and to TTY formatted data upon receiving a command from the user that the mobile is to operate in "TTY mode". Upon receiving the command from a user to operate in TTY mode, the mobile performs the conversion from and to TTY formatted data in either an analog or digital format as appropriate for signal transmission and reception at the location of mobile **10**.

Referring to Fig. 1, a block diagram of the preferred embodiment of the present invention for digital implementation of TTY capabilities into mobile handset **10** is shown. Components of mobile **10** shown in Fig. 1 include user interface depicted generally at **18** consisting of user input mechanism **12** such as a mobile alphanumeric keypad or stylus, and mobile display **14** such as a liquid crystal display (LCD), microprocessor **16**, transmitter **28**, receiver **30**, and antenna **32**.

A mobile user enters alphanumeric characters to microprocessor **16** through user input **12**. As a user enters characters, the characters are displayed on mobile display **14**. Display **14** also displays data

that has been received by mobile **10**. Microprocessor **16** controls mobile operations including user interaction - such as keypad decoding, modem operations, radio operations, control of the display of data to a user, control of storage mechanisms (memory) and control of other "peripheral" devices such as printers, scanners, digital cameras and other devices. Signals are encoded for transmission from mobile **10** and typically converted into an rf signal by transmitter **28** and transmitted from antenna **32**. Signals are received by mobile **10** by antenna **32** and receiver **30** and decoded into data meaningful to a user.

When operating in digital mode, alphanumeric data received from user input **12** is encoded into TTY formatted data by microprocessor **16** in conjunction with conversion table **20** and TTY encoder **24**. TTY encoder **24** attaches the appropriate TTY packet extension according to information stored in conversion table **20** so that the telecommunications base station and receiving mobile will interpret the incoming signal as a TTY formatted signal. The TTY formatted signal is then transmitted by transmitter **28** from mobile **10**. All alphanumeric user-input data transmitted from mobile **10** is encoded in TTY format data until a command is entered into mobile **10** to cease operation in TTY mode. When operating in TTY mode, alphanumeric data input by a user is displayed on mobile display **14** so that the user can review the communication as it is being entered.

When mobile **10** receives a signal that is digitally TTY formatted, as indicated by the appropriate packet extension on the received signal, microprocessor **16** converts the TTY formatted data into alphanumeric data with decoder **26** operating in conjunction with conversion table **20**. Once the data is converted from TTY to alphanumeric data, it is displayed on mobile display **14** to be read by the receiving user.

Referring to Fig. 2, a block diagram of the preferred analog embodiment of the present invention for implementing TTY capabilities into mobile handset **10** is shown. Conversion table **40** is stored in a memory associated with microprocessor **16**. Conversion table **40** provides the appropriate information for conversion between alphanumeric data and Baudot tone data for transmission from mobile **10** so that the telecommunications base station and receiving mobile will interpret the incoming signal from mobile **10** as a TTY formatted signal.

To operate mobile **10** in TTY mode, a user inputs a command via user input **12** to microprocessor **16**. In analog mode a suitable routine operating in microprocessor **16** in conjunction with tone generator **44** and conversion table **40**, converts data input by a user to a Baudot tone format for transmission from

mobile **10**. Once converted into Baudot tone format, the signal is transmitted by transmitter **28** of mobile **10** through mobile antenna **32** to a receiving mobile. Conversion of user-input alphanumeric data occurs until microprocessor receives a command input by a user to cease operation in TTY mode. As a user inputs alphanumeric data for conversion and transmission, the data is displayed on display **14**.

When mobile **10** receives a Baudot tone formatted signal through antenna **32**, as detected by tone detector **46**, microprocessor **16** in conjunction with conversion table **40** converts the signal into alphanumeric data. Once converted into alphanumeric data, the data is displayed on display **14** to be read by the user.

Although the invention has been described with reference to these preferred digital and analog embodiments, other embodiments can achieve the same results. Variations and modifications of the present invention will be obvious to those skilled in the art and it is intended to cover in the appended claims all such modifications and equivalents.